THE AMELIORATION OF ACID ALKALINE REACTION OF A SOIL FROM SOUTHERN OLTENIA

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ABSTRACT

There were made determinations on soil reaction at S.C. Podere Risabella SRL which is located on the territory of Gighera commune, Dolj County. The zone is characterized by a gleyc salinic alluvial soil, the water table is at 0.2-6.0 m and the underground water is very mineralized, with a high content of bicarbonates, sodium and magnesium chlorides and the exchangeable sodium records values between 0.174-2.800 mg/100g soil. There were recommended measures of balancing the alkaline reaction by amendments and lowering the water table.

REZUMAT

S-au făcut determinări agrochimice la unitatea agricolă S.C. Podere Risabella SRL, situate pe teritoriul comunei Gighera, Judeţul Dolj. Zona este caracterizată de un aluvisol gleic salinic, nivelul apelor freatice variază între 0,6-6,0 m adâncime, apele freatice sunt puternic mineralizate, cu un conţinut ridicat de bicarbonate, cloruri de sodium şi magneziu iar sodiul schimbabil are valori cuprinse între 0,174-2,800 mg la 100 g sol. S-au recomandat măsuri de neutralizare a reacţiei bazice prin aplicarea de amendamente şi coborârea nivelului apei freatice.

INTRODUCTION

Salty soils are characterized by a high concentration of soluble salts into soil solution, by high sodium content within soil adsorptive complex and by an alkaline pH of water soil solution. Some of these soils are located in low steppe and sylvosteppe from Romanian Plain with underground water at low depth, in zones where evaporation overpasses rainfall during summer which determines capillary elevation of underground water that evaporates and leaves salts in the shallow soil horizon. This kind of soils is located in Danube lowland. The alkalinity of these soils affects the agricultural productions and it must be ameliorated by agrochemical methods.

The present paper presents researches made in Gighera commune area, on alkaline soil in order to establish measures of their amelioration.

MATERIAL AND METHOD

The soil samples have been taken from 0-20 cm depth from an area of gleyc saline soil formed on fluviatile deposits which were planted by woods.

At the soil surface there appears a pellicle of salts resulted from water evaporation from underground through capillarity. Other soil samples have a silty texture or silty clayey texture, with low or very low porosity, strongly gleysated, tough. With these samples there can be observed the stratification of successive layers of fluviatile materials that form a structure of lamina, resembling a lamellar ore as well as evident deposits of iron oxides formed by gleysation process.

The alkaline soil reaction is given by water solution pH, total sodium content and exchangeable sodium content of the soil. On the basis of these parameters there were calculated the amendment rates for recovering the alkaline reaction of the soil.

The exchangeable sodium represents the difference between the total sodium content (exchangeable and soluble) extracted from the soil with ammonium chloride or ammonium acetate and the water soluble sodium by distilled water. The sodium content was determined by photometry, both in water and saline extract, after official method for our country.

The determination of pH was made in water solution at water – soil ratio of 1:1.25.
The interpretation of results was made after the following scale:

The actual acidity of soils after pH values:

pH value	Soil reaction
Under 5	strong acid
5.0-5.8	acid
5.8-6.8	low acid
6.8-7.2	neutral
7.2-8.4	low alkaline
8.4-9.0	alkaline
Over 9.0	strongly alkaline

Exchangeable sodium Na_{exc} (me/100 g soil)

Values	Echangeable sodium content
Under 1	very low
1-3	low
3-6	average
6-15	high
Over 15	very high

The calculus of amendments rates on alkaline soils is made in function of exchangeable sodium, the adsorbed sodium and in function of the soil content in carbonates and bicarbonates. The time when the amendments should be applied are given by the opportunity and urgency of amendments application determination.
The opportunity of gypsum emendment applying.
The gypsum amendment applying is required in the following situations:
- pH > 8;
- PSA > 10%
- RSA > 0.11%
- $C_{CO3} + C_{HCO3} >$ 1me/100g soil.

The urgency of gypsum amendment applying (UG)
UG=4,0-0,1PSA

The gypsum urgency ranges between nill (ASP = 40% reaching toxicity for many crops. ASP – amendment solubility power) and four (when ASP = 0; with not saline or salty soils). The highest urgencies are for soil with lowest UG. After UG, the scale is as follows:

urgency 1-a, when *UG*=0 - 1
urgency 2-a, when *UG*=1 - 2
urgency 3-a, when *UG*=2 - 3
urgency 4-a, when *UG*=3 - 4
When *UG*=4 there is no need to apply amendments

The calculus of Na amendments

1. In function of Na_s (me/100 g soil)

$$R_{GA} = (Na_s \cdot 86.10.3.10^6) / 10^9 \text{ t } CaSO_4\ 2H_2O/\text{ha},$$

where
R.G.A. = rate of gypsum amendments
86= gypsym miliequivalent = mg de gips ($Ca\ SO_4 2H_2O$) needed for neutralizing (removing from the adsorptive complex and replacing by Ca or Mg) of 1 me Na_s from 100 g soil.
10 = for neutralizing 1 kg of soil.
$3 \cdot 10^{-9}$ = mg gypsum for neutralizing the mass of soil from a hectare.
10^{-9} = for transforming mg gypsum/ha in t gypsum/ The soil samples have been taken from 0-20 cm depth from an area of gleyc saline soil formed on fluviatile deposits

which were planted by woods.

The applying of amendments on soils with carbonates is made with the aim to remove the carbonates and bicarbonates by transforming them in CO2 and H2O and for replacing the exchangeable sodium from the soil adsorptive complex by other ions, especially Ca2+ and Mg2+ yet by H+, too.

On soils with carbonates there are recommended gypsum and phosphogypsum and on salty soil with chlorides and sulphur compounds there are recommended phosphogypsum followed by washings and on low salted soils, where Na is replaced by H, there are recommended lime and CaCO3.

We consider that the phosphorus amendment is recommended on this kind of soils (on several years) as well as the maintaining of channels of draining for reclaiming this kind of soils.ha.

RESULTS AND DISCUSSIONS

The analytical results of soil samples as well as the amendment rates by phosphogypsum are presented in the table 1.

Table 1.

Analytical results of soil samples

No.	pH in H_2O	Total Na mg/100 g soil	Soluble Na in water mg/100 g soil	Exchangeable Na mg/100 g sol	Phosphogypsum rate t/ha
1	8.15	6.391	3.548	2.843	7.335
2	8.19	5.130	2.330	2.800	7.224
3	8.23	3.695	1.974	1.721	4.440
4	8.18	3.652	2.087	1.565	4.038
5	8.56	8.522	4.061	4.461	11.509
6	8.37	7.130	3.809	3.321	8.568
7	8.51	14.087	6.000	8.087	20.864
8	8.76	12.087	5.035	7.052	18.194
9	8.03	6.913	3.583	3.330	8.591
10	8.55	10.652	5.226	5.426	13.998

There can be observed that 60% of soil samples have a low alkaline reaction and 40% have an alkaline reaction; for 40% of soil samples the exchangeable sodium records low values, for 40% average values and for 20% there are recorded high values of this parameter.

CONCLUSIONS

Because all soil samples have values higher than 8 the gypsum is needed and opportune there were calculated the gypsum amendment rates. Some of these rates are too big and, for this reason, they must be applied in 2 or 3 doses.

The studies on this issue should be continued and deepened.

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